CLAIMS

What is claimed is:

1 1.   A method for constructing a soft device, the method comprising:

2   implementing a driver of the soft device in a virtual machine monitor;

3 and

4   making the soft device available for use by one or more virtual

5 machines coupled to the virtual machine monitor.

1 2.   The method of claim 1 wherein the one or more virtual machines run

2 arbitrary operating systems for which no corresponding soft device drivers

3 exist on the market.

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1 3.   The method of claim 1 wherein making the soft device available for use

2 by one or more virtual machines further comprises:

3   exporting an emulation of a fixed function hardware device to said any

4 of the one or more virtual machines.

1 4.   The method of claim 3 wherein exporting the emulation of the fixed

2 function hardware device comprises:

3   performing computations requested by said any of the one or more

4 virtual machines without notifying a residual fixed function device.

1   5.   The method of claim 3 wherein exporting the emulation of the fixed

2   function hardware device comprises:

3   transferring an operation requested by said any of the one or more

4   virtual machines to a residual fixed function device; and

5   the residual fixed function device performing the operation requested

6   by said any of the one or more virtual machines.

1   6.   The method of claim 3 wherein exporting the emulation of the fixed

2   function hardware device comprises:

3   performing a portion of computations requested by said any of the one

4   or more virtual machines to a residual fixed function device; and

5   performing a set of operations on hardware registers of a residual fixed

6   function device to complete a task requested by said any of the one or more

7   virtual machines.

1   7.   The method of claim 3 wherein exporting the emulation of the fixed

2   function hardware device comprises:

3   manipulating data stored in memory to effect zero or more

4   transformations; and

5   transferring data to or from a residual hardware device using a direct

6   memory access (DMA) technique.

1   8.   A system comprising:

2   a hardware platform including a hardware component of a soft device;

3 a virtual machine monitor, coupled to the hardware platform, the

4 virtual machine monitor including a driver of the soft device; and

5 one or more virtual machines, coupled to the virtual machine monitor,

6 the one or more virtual machines utilizing the soft device when needed.

1 9. The system method of claim 8 wherein the one or more virtual

2 machines run arbitrary operating systems for which no soft device drivers

3 exist on the market.

1 10. The system of claim 8 wherein the driver of the soft device is to export

2 an emulation of a fixed function hardware device to said any of the one or

3 more virtual machines.

1 11. A method for constructing a soft device, the method comprising:

2 implementing a software component of the soft device in a first virtual

3 machine; and

4 making the soft device available for use by a second virtual machine.

1 12. The method of claim 11 wherein the second virtual machine runs an

2 arbitrary operating system for which no corresponding soft device drivers

3 exist on the market.

1 13. The method of claim 11 wherein making the soft device available for

2 use by the second virtual machine further comprises:

3   presenting the first virtual machine to the second virtual machine as an

4   external device; and

5   emulating communication between the first virtual machine and the

6   second virtual machine.

1   14.   The method of claim 13 wherein emulating communication further

2   comprises:

3   providing a virtualized serial communications link;

4   providing a virtualized serial communications port to each of the first

5   virtual machine and the second virtual machine;

6   linking the virtualized serial communications port provided to the first

7   virtual machine to the software component of the soft device using reflection

8   software;

9   trapping each access by one of the first virtual machine and the second

10   virtual machine to the virtualized serial communication port; and

11   reflecting said each access to the other of the first virtual machine and

12   the second virtual machine via the virtualized serial communications link.

1   15.   The method of claim 13 wherein emulating communication further

2   comprises:

3   providing a virtualized universal serial bus (USB) to USB bridge

4   device;

5   providing a virtualized USB host controller to each of the first virtual

6   machine and the second virtual machine;

7   linking the virtualized USB host controller provided to the first virtual

8   machine to the software component of the soft device using reflection

9   software;

10   trapping each access by one of the first virtual machine and the second

11   virtual machine to the virtualized USB host controller; and

12   reflecting said each access to the other of the first virtual machine and

13   the second virtual machine via the virtualized USB to USB bridge device.

1   16.   The method of claim 11 wherein making the soft device available for

2   use by the second virtual machine further comprises:

3   presenting the first virtual machine to the second virtual machine as an

4   internal device; and

5   emulating communication between the first virtual machine and the

6   second virtual machine.

1   17.   The method of claim 16 wherein emulating communication further

2   comprises:

3   providing a virtualized peripheral component interconnect (PCI) bus;

4   linking the virtualized PCI bus to the software component of the soft

5   device using reflection software;

6   trapping each access by one of the first virtual machine and the second

7   virtual machine to the virtualized PCI bus; and

8   reflecting said each access to the other of the first virtual machine and

9   the second virtual machine.

1   18.   The method of claim 11 wherein making the soft device available for

2   use by the second virtual machine further comprises:

3   emulating a network communication between the first virtual machine

4   and the second virtual machine by providing a virtual network interface card

5   (NIC) to each of the first virtual machine and the second virtual machine.

1   19.   The method of claim 11 wherein making the soft device available for

2   use by the second virtual machine further comprises:

3   presenting the first virtual machine to the second virtual machine as a

4   hardware device; and

5   emulating communication between the first virtual machine and the

6   second virtual machine.

1   20.   The method of claim 19 wherein emulating communication further

2   comprises:

3   providing a virtualized peripheral component interconnect (PCI) bus;

4   trapping each access by one of the first virtual machine and the second

5   virtual machine to the virtualized PCI bus; and

6   reflecting said each access to the other of the first virtual machine and

7   the second virtual machine via the virtualized PCI bus.

1   21.   The method of claim 19 wherein emulating communication further

2   comprises:

3   providing a virtualized universal serial bus (USB) connection;

4   providing a virtualized USB bus interface to the first virtual machine;

5   providing a virtualized USB host controller to the second virtual

6   machine;

7   trapping each access by one of the first virtual machine and the second

8   virtual machine to the virtualized USB bus; and

9   reflecting said each access to the other of the first virtual machine and

10   the second virtual machine via the virtualized USB connection.

1   22.   The method of claim 19 wherein the hardware device is any one of a

2   PCI card, an external USB device, an internal USB device, and any other

3   standard personal computer peripheral device.

1   23.   The method of claim 19 wherein presenting the first virtual machine to

2   the second virtual machine as a hardware device further comprises:

3   configuring the first virtual machine to match the hardware device.

1   24.   The method of claim 23 wherein the software component of the soft

2   device comprises at least a portion of software of a fixed function device.

1   25.   The method of claim 24 further comprising:

2   varying the portion of software that is used as the software component

3   depending on how closely the first virtual machine matches the hardware

4   device.

1   26.   A method for constructing a soft device, the method comprising:

2   implementing software components of the soft device in a plurality of

3   dedicated virtual machines; and

4   making the soft device available for use by a main virtual machine.

1   27.   The method of claim 26 wherein the main virtual machine runs an

2   arbitrary operating system for which no corresponding soft device drivers

3   exist on the market.

1   28.   The method of claim 26 wherein making the soft device available for

2   use by the main virtual machine further comprises:

3   presenting the plurality of dedicated virtual machines to the main

4   virtual machine as a hardware device; and

5   emulating communication between the plurality of dedicated virtual

6   machines and between each of the plurality of dedicated virtual machines and

7   the main virtual machine.

1   29.   The method of claim 28 wherein emulating communication further

2   comprises:

3   providing a virtualized communication means to the plurality of

4   dedicated virtual machines and to the main virtual machine.

1   30.   The method of claim 29 wherein the virtualized communication means

2   is any one of a virtualized serial communications link, a virtualized universal

3   serial bus (USB) to USB bridge device, a virtualized peripheral component

4   interconnect (PCI) bus, a virtual network interface card, and a virtualized USB

5   connection.

1   31.   A system comprising:

2   a hardware platform including a hardware component of a soft device;

3   a virtual machine monitor, coupled to the hardware platform; and

4   a plurality of virtual machines, coupled to the virtual machine monitor,

5   the plurality of virtual machines including one or more dedicated virtual

6   machines, in which one or more software components of a soft device are

7   implemented, and remaining one or more virtual machines utilizing the soft

8   device when needed.

1   32.   The system of claim 31 wherein any of the remaining virtual machines

2   runs an arbitrary operating system for which no corresponding soft device

3   drivers exist on the market.

1   33.   The system of claim 31 wherein the VMM is to make the soft device

2   available by presenting the dedicated virtual machines to the remaining

3   virtual machines as one or more external devices and emulating

4   communication between the plurality of virtual machines.

1   34.   The system of claim 31 wherein the VMM is to make the soft device

2   available by presenting the dedicated virtual machines to the remaining

3   virtual machines as one or more internal devices and emulating

4   communication between the plurality of virtual machines.

1   35.   The system of claim 31 wherein the VMM is to make the soft device

2   available by emulating a network communication between the plurality of

3   virtual machines by providing a virtual network interface card (NIC) to each

4   of the plurality of virtual machines.

1   36.   The system of claim 31 wherein the VMM is to make the soft device

2   available by presenting the dedicated virtual machines to the remaining

3   virtual machines as a hardware device and emulating communication

4   between the plurality of virtual machines.

1   37.   The system of claim 36 wherein the hardware device is any one of a

2   PCI card, an external USB device, an internal USB device, and any oother

3   standard personal computer peripheral device.

1   38.   The system of claim 36 wherein the VMM is to emulate communication

2   by providing a virtualized communication means to the plurality of virtual

3   machines.

1   39.   The system of claim 38 wherein the virtualized communication means

2   is any one of a virtualized serial communications link, a virtualized universal

3   serial bus (USB) to USB bridge device, a virtualized peripheral component

4   interconnect (PCI) bus, a virtual network interface card, and a virtualized USB

5   connection.

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1   40.   A computer readable medium that provides instructions, which when

2   executed on a processor, cause said processor to perform operations

3   comprising:

4   implementing a driver of the soft device in a virtual machine monitor;

5   and

6   making the soft device available for use by one or more virtual

7   machines coupled to the virtual machine monitor.

1   41.   The computer readable medium of claim 40 wherein the one or more

2   virtual machines run arbitrary operating systems for which no corresponding

3   soft device drivers exist on the market.

1   42.   A computer readable medium that provides instructions, which when

2   executed on a processor, cause said processor to perform operations

3   comprising:

4   implementing a software component of the soft device in a first virtual

5   machine; and

6   making the soft device available for use by a second virtual machine.

1   43.   The computer readable medium of claim 42 wherein the second virtual

2   machine runs an arbitrary operating system for which no corresponding soft

3   device drivers exist on the market.

1   44.   A computer readable medium that provides instructions, which when

2   executed on a processor, cause said processor to perform operations

3   comprising:

4   implementing software components of the soft device in a plurality of

5   dedicated virtual machines; and

6   making the soft device available for use by a main virtual machine.

1   45.   The computer readable medium of claim 44 wherein the main virtual

2   machine runs an arbitrary operating system for which no corresponding soft

3   device drivers exist on the market.